

**SUPPORT FOR THE AMENDMENTS**

New Claim 39 is based on previous Claim 1 as set forth in the Preliminary Amendment, with the limitations of Claims 8, 9, and 35.

The remainder of the claims find support in the original and/or amended depending claims.

Accordingly, it is respectfully submitted that there is no possibility of new matter and entry is respectfully requested.

### **REMARKS/ARGUMENTS**

Claims 39 - 54 are in the case.

The present claims are directed to a process for hydrogenating unsaturated organic compounds with hydrogen in the presence of a catalyst which comprises a catalytically active Group VIII metal(s) disposed on a support. At least one of the catalytically active Group VIII metal sites is required to have been obtained via the partial decomposition on the support of a complex of the metal and a compound selected from amino acids and compounds containing amino groups and hydroxyl groups. Furthermore, the partial decomposition is required to be such that the complex exhibits a new infra-red vibration band between 2100 and 2200 cm<sup>-1</sup>.

There is a plethora of prior art - such as D2-D8 (using the abbreviations set forth in by the PCT examining authority, such documents believed to be of record in the present case, at least by reference thereto), and including the prior art set forth in the Official Action of September 3, 2008, by the U.S. Examiner, (e.g., Brunner et al, U.S. 6,284,917; Sugier et al, U.S. 3,761,428; and Scott, U.S. 2,889,287) teaching processes for hydrogenation of organic compounds using catalysts prepared by techniques that involve use of either an amino acid or an amino alcohol compound to form a metal complex on a support. However, in each prior art document the metal complex is fully decomposed (with the possible exception of D4, where the catalyst is either fully decomposed or, in certain teachings, not decomposed at all). Note that the D1 referred to by the PCT examining authority, teaches hydrogenation of carbon monoxide, not hydrogenation of organic compounds.

Accordingly, the present claims are directed to a process that differ notably by the distinction between partial and fully decomposed complex, but otherwise within the skill of the "ordinary" artisan as described by the Examiner in the Official Action of September 3, 2008, to carry out.

However, notwithstanding the aforementioned, Applicants disagree with the specific description of the level of skill in the art. Applicants respectfully assert that the ordinary artisan in this field would have a PhD and many years of experience, and would have one or more "BS Chemists" working for him or her to carry out "routine experimentation".

The present specification provides copious instruction in carrying out the partial decomposition and the teaching concerning the infra-red feature may be found at page 46 line 21 to page 47 line 4 of the present description (e.g., paragraph 142). This states that where the organic compound is an amino acid or an amino alcohol, the partial decomposition is shown by the formation of the new vibration bands. These are said to be tentatively assignable to complex carbon nitrogen species such as nitriles and isonitriles being present in the partially decomposed organic complex.

The references of record as represented by D1-D8 are all essentially concerned with the same problem, which is how to efficiently hydrogenate certain compounds by catalytic means. The hydrogenation is accomplished in each case by using a catalyst that has a dispersion of catalytically active metal over a support. In each case the catalyst is one produced by a technique that includes forming an amino acid - or amino alcohol - metal complex on the support and decomposing the complex.

The catalyst employed in the hydrogenation processes of D1 to D8 (in those cases where there is decomposition of the metal complex carried on the support) is one obtained by a technique that includes fully decomposing the complex such that oxidized metal sites are formed on the support.

In contrast, the hydrogenation process of the claimed invention uses a catalyst obtained via a technique that includes partially decomposing the metal-organic compound complex on the support.

The difference between the two techniques is the extent of decomposition of the metal-organic compound complex. The partial decomposition required by the invention results in an improved catalyst for the specified hydrogenation process, compared with the catalyst produced by the prior art methods.

Without wishing to be bound by theory, a key to good catalyst performance is the degree of the dispersion of the catalytically active metal sites on the support. This aspect is specifically discussed at page 44 lines 1-5 of the description which reads:

"An important parameter in the activity of catalytically active metals is the form of the metal on the support and the level of dispersion of the metal on the support. The process of the present invention produces hydrogenation catalysts that comprise catalytically active metal sites

that are relatively small and highly dispersed. In addition the level of dispersion is relatively stable."

The reasons for the achievement of this unexpected technical effect have been assessed by the Applicants, and, again without wishing to be bound by theory, may be explained as follows. Looking first to the case where the metal-organic compound complex is fully decomposed on the support, this results in the formation of metal oxide particles on the support. These metal oxide particles are very mobile, and readily form agglomerates of metal oxide particles. That is, large agglomerates are formed on the surface of the support, meaning that there is a relatively poor dispersion.

A reduction treatment (typically carried out to activate the metal) results in the reduction of the agglomerates of metal oxides. This results in the formation of (reduced) catalytically active metals, but the metal particles are still contained in the form of agglomerates. Thus, the active metal sites are in the form of relatively large particles which are, therefore relatively poorly dispersed and, it has been found, the catalyst is less stable. Because of the size of the active metal particles and relatively poor dispersion, such catalysts have a relatively lower activity for hydrogenation of organic compounds.

In contrast, partial decomposition results in the formation on the surface of the support of a metal/organic complex material, which will contain some oxide. These materials have the infra-red bands required by Claim 39, and because the material is not entirely metal oxide, the particles are not mobile (certainly not as mobile as the metal oxide without any remnant organic material associated therewith). Thus, the partially decomposed metal complexes do not agglomerate and form large particles. Rather, they remain dispersed across the surface of the support (as would be expected since the metal was originally introduced into the support for example by impregnation from solution). The metals therefore remain well dispersed. Subsequent reductant treatment to activate the metal results in the formation of small, well dispersed active metal sites which have been found to have high stability and higher activity than those catalysts (all other things being equal) made by the full decomposition technique. The extent of the partial decomposition enables control of the extent of dispersion and size of the ultimate metal particles on the support surface, and

therefore enables the manufacturer to control the level of activity of the catalyst to desired ranges best suited to hydrogenation conditions.

Applicants also traverse another of the allegations set forth in the Official Action of September 3, 2008, and that is that "the instant claimed invention is highly unpredictable since one skilled the art would recognize that not every .... organic starting material would produce the desired hydrogenated products".

As evidenced by the art of record, the art of hydrogenation is NOT so unpredictable that, once given an explanation of the difference between the prior art and a new way of doing things, one of ordinary skill in the art can practice the invention without undue experimentation.

In addition, once a catalyst system is shown to hydrogenate unsaturated organic compounds, generally the catalyst system in all its variants will hydrogenate most if not all unsaturated organic compounds, and furthermore Applicants respectfully note that the law has never been such that all possible species encompassed by a claim be enabled nor even that all possible variations actually work on every conceivable species.

Finally, Applicants note that they are not claiming that all species of unsaturated organic compounds may be hydrogenated by the method of the invention. Rather, we are claiming only those cases limited by the clause "**whereby at least one of said one or more unsaturated organic compounds are hydrogenated**". So, if nothing is hydrogenated, it doesn't fall within the claims. We don't need to teach how to hydrogenate everything - only those things hydrogenated by the present method.

In view of the above arguments, especially the numerous references of record indicating that hydrogenation of unsaturated organic compounds using support Group VIII compounds is entirely routine *per se*, and the relatively narrow scope of the amended claims presented *supra*, **Applicants respectfully request the withdrawal of the rejection under 35 USC §112.**

As suggested in the above arguments, nothing in D1 to D8 (again, using the referencing used by the PCT preliminary examination authority) teaches that partial decomposition of such amino acid or amino alcohol complexes as now defined in Claim 39, is a step in the synthesis procedures taught for the catalysts used in D1 to D8. The amended Claim 39, is therefore, both clear, and clearly novel.

Applicants make the following observations in support of patentability of the invention now defined in Claim 39.

The art of record, as represented by D1-D8, are all essentially concerned with the same problem, which is how to efficiently hydrogenate certain compounds by catalytic means. The hydrogenation is accomplished in each case by using a catalyst that has a dispersion of catalytically active metal over a support. In each case the catalyst is one produced by a technique that includes forming an amino acid - or amino alcohol - metal complex on the support and decomposing the complex.

The catalyst employed in the hydrogenation processes of D1 to D8 (in those cases where there is decomposition of the metal complex carried on the support) is one obtained by a technique that includes fully decomposing the complex such that oxidized metal sites are formed on the support.

More specifically, addressing the specific references used in the rejection:

(1) Brunner et al. (US 6,284,917 or "D12") discloses a method of hydrogenating benzene polycarboxylic acids with hydrogen using a catalyst comprising a transition metal catalyst on a support that contains macropores, optionally also with micropores and/or mesopores. The catalyst may be prepared by impregnating a transition metal salt into the support followed by drying and optionally calcining at 200-600° C, preferably 350-450° C [Col. 4 lines 1-5, col. 5 lines 32-34, col. 6 lines 62-65]. The salts may be, e.g., nitrates, nitrosyl nitrates, halides, ammine complexes of the metal etc, but there is no teaching to employ a nitrogen-containing organic compound in the catalyst preparation. The sole example of catalyst synthesis [Col. 12 lines 26-47] uses a nitrate solution and does not calcine the product. There is, therefore, no decomposition of an organic nitrogen-containing complex, partial or full.

(2) Sugier et al. (U.S. 3,761,428 or "D2") teaches the deposition of platinum and iridium on to a support using an aminoalcohol solution (col 1 lines 51-54). Activation of the resultant catalyst is by a technique that involves full decomposition of the organic material. For example, at column 4 line 7, activation is by heating at 520° C/4 hours. These same conditions are used in example 7 at column 6, lines 53-54. As may be seen from the examples of the instant application, a temperature of 520° C would give full decomposition of

the organic material. The catalysts of D2 are said to be useful in the hydrogenation of hydrocarbons, e.g., petroleum cuts (Example 6).

(3) Scott (U.S. 2,889,287 or "D3") uses an aminoacid solution to impregnate a catalytic metal onto a support as a chelate (column 2 lines 36-41). However, the chelate is fully decomposed (column 2 lines 40-41). See also column 3 lines 67-70 where it is stated that after drying. The metal-chelate compound is decomposed to the metal or metal oxide by calcining. Conditions typically used to achieve this are calcining for 2 hours at 830° F, 2 hours at 930° F and 12 hours at 1030° F (column 4 lines 71-71, with corresponding statements in most of the other examples, where calcination conditions are specified). See also claims 1, 4, 6, 8 and 9, where, at their respective final lines calcination is said to be "to decompose the chelate".

Thus the difference between all of the prior art of record, and more specifically the references used in the rejection, distinguished above, is the extent and nature of the decomposition of the metal-organic compound complex. The partial decomposition of an amino acid-based or amino-hydroxyl-based compound required by the invention results in an improved catalyst for the specified hydrogenation process, compared with the catalyst produced by the prior art methods.

Thus, the combination of the references Brunner et al., Sugier et al., and Scott, taken as a whole, are devoid of any suggestion of the partial decomposition feature set forth in the principal claim, and thus cannot fairly suggest the present claims.

Accordingly, it is respectfully requested that the rejection under 35 USC §103 be withdrawn.

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There being no further issues, it is believed that the present invention is now in condition for allowance and early notice to this effect is earnestly solicited.

Respectfully submitted,

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Date

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